

MULTI-PURPOSE MILITARY DISPLAYS

STROMBERG-CARLSON

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MILITARY DISPLAY REQUIREMENTS

With the increased military use of computers for data processing, a requirement exists for electronic data displays which can withstand the necessary operational environments. Stromberg-Carlson, with years of experience in data displays has developed equipment which can withstand the shock, vibration, humidity and temperature variations inherent in such environments. In addition, the equipment is compactly designed to fit situations where space and weight are at a premium. A special cathode ray tube is used for data display since the cathode ray tube can handle a large quantity of changing data faster than any other technique.

The equipment can be airborne or air transportable. It is suitable for transporting to forward positions by aircraft or helicopter. Because of its compact size, the equipment is also usable on ships, may be van mounted or may be used in other situations such as underground and underwater command posts where space is limited. In addition, low power consumption makes it ideal for military display situations.

APPLICATIONS

To provide a link between man and data processing systems, the displays can visually present a wide variety of computer-generated information as well as data from other sources such as radar, television and communications links.

The displays can serve in many tactical and military management systems. In an aerospace situation, for instance, they can assist in airborne or ground based command and control. In a typical application, using data compiled by a computer, the displays may provide information to pilot and crew on possible targets, position of friendly troops, aircraft positions, etc.

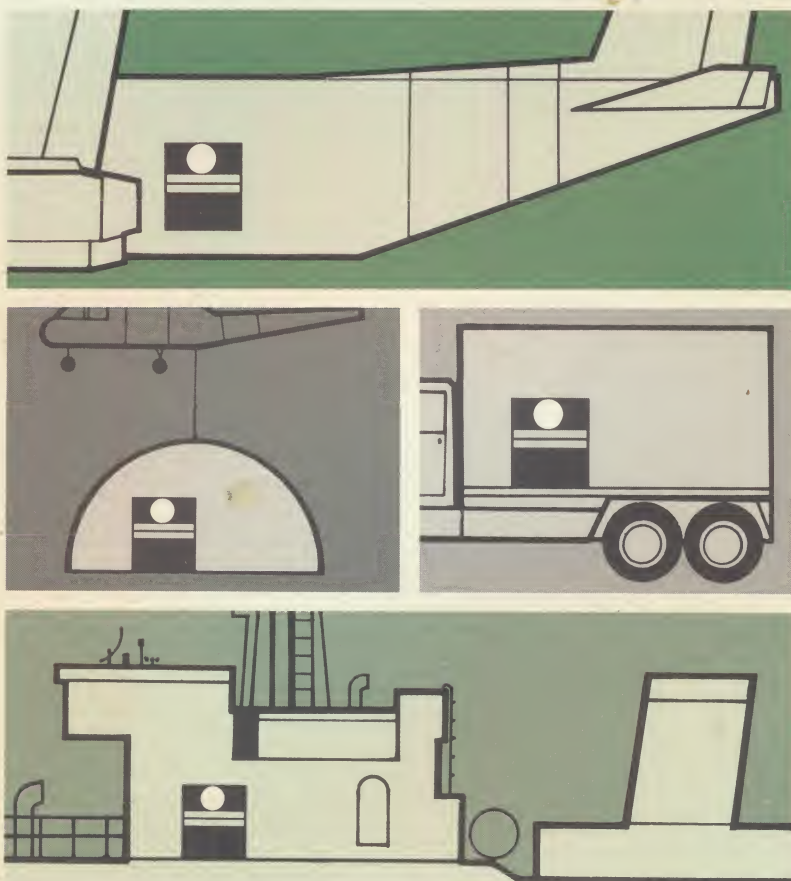
The equipment also is suitable for tactical planning, warning and control and fire control systems. Missile launching can be monitored on the display. Studies now underway show its applicability to use in space vehicles.

In naval operations the displays are already in use in an ASW system and can be used for navigation purposes. Weather data can be easily displayed as well.

For other operations the displays may be used in forward or rear echelon command posts. Military management programs which can use the displays are logistics, personnel planning or any other system which uses electronic data processing and requires display of the processed information to an operator or command personnel.

Besides displaying information, consoles are equipped with devices for communicating with the data source. With this capability the operator can question the computer concerning specific targets or items of information and can rapidly solve complex problems.

Typical applications include airborne, helicopter huts, van mounting and shipboard.



EXPERIENCE

Stromberg-Carlson's experience in data display dates back more than a decade to the SAGE air defense system for which the organization developed special cathode ray tube equipment. Other major military display projects include combination displays and printers for the U.S. Army War Room in the Pentagon. Features of this system include a built-in keyboard, joy stick and other controls. Stromberg-Carlson also supplied the Sea Surveillance Tactical Display for the Navy, and BASIC, a system instantly transmitting battlefield situation information from front line Marines to rear echelon headquarters for visual presentation on a special cathode ray tube. Other experience includes development of the Mercury Control Center at Cape Kennedy, a series of custom displays for military and government agencies and a widely used direct view display console known as the S-C 1090.

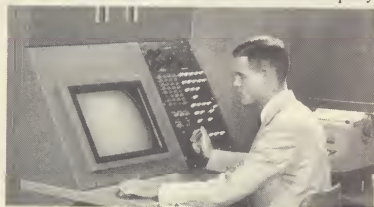
SAGE Air Defense Display System



Army War Room Display and Printer



SEA SURVEILLANCE Tactical Display



BASIC Battlefield Display



A-NEW PROGRAM

Stromberg-Carlson has proven its capabilities in developing military airborne displays through provision of the displays for the A-NEW program. The displays which are being supplied for A-NEW, the anti-submarine warfare development program of the Naval Air Development Center, are typical of the equipment it is capable of supplying for similar projects.

The most comprehensive situation display ever provided a pilot and crew of an aircraft, the Stromberg-Carlson consoles for A-NEW operate with the Navy's new airborne digital computer system. The display takes

commands from the computer which considers all data received from electronic sub-hunting equipment, communications links and other sources.

Information which is visually presented to the airborne tactical coordinator includes vectors, text and tabular data on such factors as tactical and navigational problems. Situation maps showing locations of possible targets, and other ships and planes in the area may be presented simultaneously.

Present system developments include displays of varying sizes for presentation of data to various ASW crew members. Several displays will be portable and interchangeable.

Stromberg-Carlson supplied the display console shown here for the Navy's A-NEW Program.



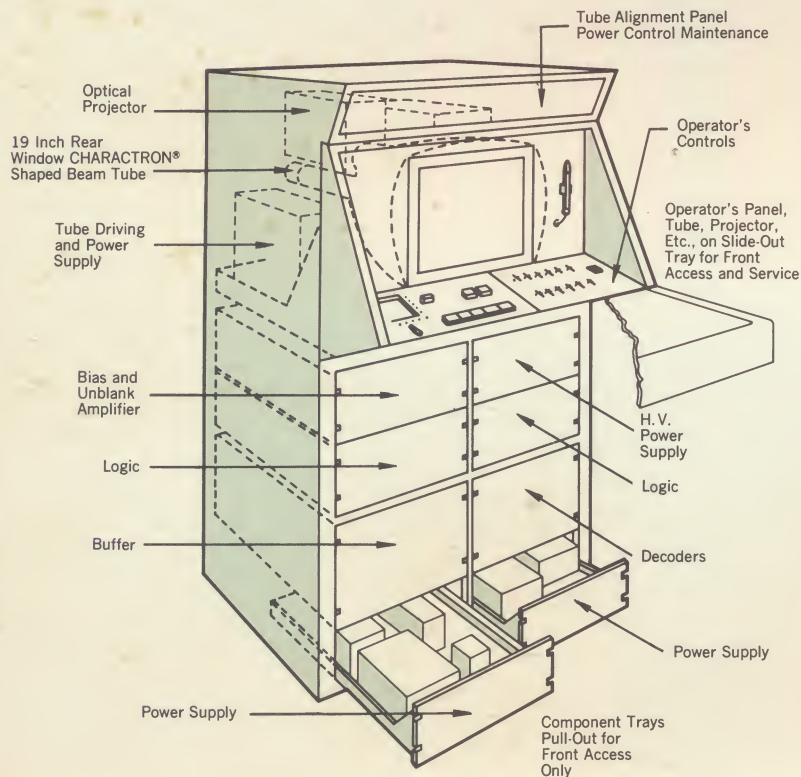
CONSOLE DESIGN

The typical Stromberg-Carlson military display is entirely self-contained. Included besides the display are operator controls, power supply, logic circuitry, amplifiers, decoders and buffers. One magnetic core buffer has a total storage of 1024 words with a 6 microsecond cycle time. The buffer can be addressed for random loading and has a 40 cycle frame reiteration rate. Others are available.

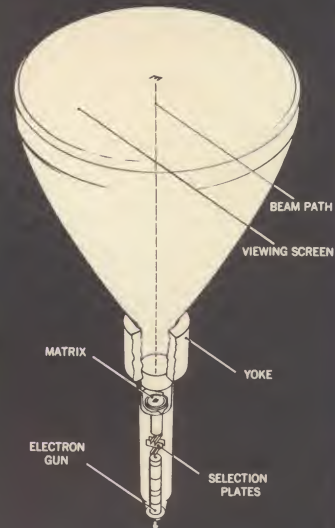
The unit operates from 115/230 volts, 400 cycles ac, 4 wire three phase, 1700 watts. Weighing only about 400 pounds, the console has a total cubage of 30 cu. ft. ($2\frac{1}{2}' \times 4' \times 3'$). Stromberg-Carlson has used the latest packaging techniques to reduce the weight and size of the displays to a minimum wherever required. Microminiaturized models can be supplied.

Modular construction is employed so the display and related equipment can be installed in one area and supporting equipment such as power supplies can be installed elsewhere when space limitations require. For example, the display may be installed forward in an aircraft for pilot viewing, while other equipment may be placed where space is available.

Where more than one display console is employed in a system, all displays can receive all data and all tasks can be performed from any display. For specific situations, the consoles can be modified easily. For instance, a horizontal model can be provided as well as rack and panel mounted systems.



CHARACTRON® SHAPED BEAM TUBES



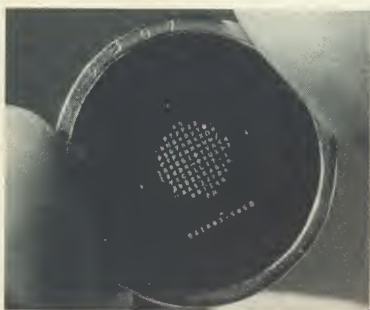
Information is displayed on tube screens ranging from 5" to 21" in diameter. Many of these tubes used in the SAGE system achieved 20,000 hours or more of reliable performance.

Heart of the CHARACTRON Tube is a stencil-like matrix, a tiny disc with alphanumeric and symbolic characters etched through it. The matrix is placed within tube neck, in front of an electron gun.

The electron stream is extruded through a selected character in the matrix, forming the beam into the desired character shape. When the beam impinges on the phosphor-coated tube face, the character is reproduced. In compact tubes the entire matrix is flooded with electrons, generating a complete array of characters. Only the desired character is allowed to pass through a masking aperture. By actually forming the character or symbol from the electron beam, the tube provides the highest available definition of character generation and overall display quality.

CHARACTERS AND SYMBOLS

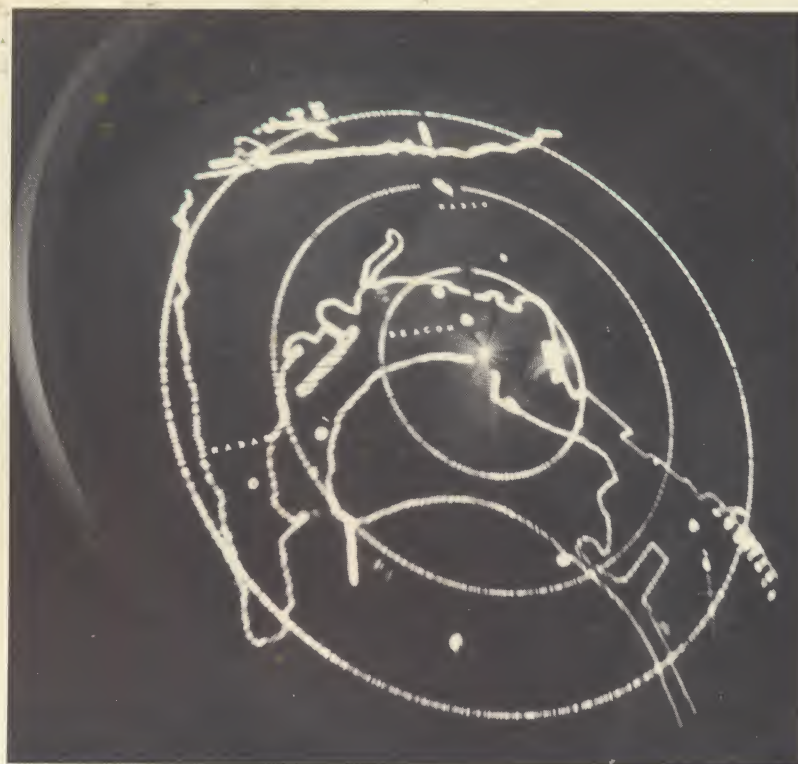
Matrices with as many as 192 characters are available, and special repertoires can be designed. Display character size is recommended to be 0.120; but can be designed to fit the user's requirement. Character sizes can be varied dynamically. Normally, the repertoire will contain all desired characters and symbols, but additional ones can be created externally. The CHARACTRON Tubes provide the fastest known means of character generation due to the inherent simplicity of the beam-shaping principle. The tubes are capable of operating at excess of 100,000 characters per second.



Etched matrix containing 96 characters and symbols.

WRITING MODE

The CHARACTRON Tube is not limited to production of characters and symbols. Using a typical spot size of 0.012 it draws vectors and produces curves and line segments (vectors) with which special figures or symbols may be produced. Therefore, besides providing tabular readout, it can draw graphical displays complete with any necessary annotations.



DISPLAYED DATA

By sharing tube time between digital and analog sources, the display can present combinations of alphanumeric, symbolic and graphical data along with information from scan converters, television, radar and other sensor devices. Such raster data may be presented with writing rates as high as one inch per microsecond. To emphasize a specific item on the display area, selected information may be blinked repeatedly or the level of brightness may be raised to separate the data from surrounding information. Also, character sizes may be dynamically varied to add emphasis.

COMPUTER COMMUNICATION

To enable an operator to communicate with the data source, the Stromberg-Carlson displays are equipped with keyboards through which information can be sent to the computer. Also available are light pens with which an operator can identify a target on the tube face so additional information on that particular item can be obtained from the data processing equipment. Another means for operator communication with the computer is a track ball or joy stick which is used to move a cursor from one point to another on the tube face, and automatically generate and return positional data to the computer.

INPUTS

To date, consoles have been developed which use inputs of 18, 24, 30 and 36 bit words. However, the system is flexible and can be adapted to other data sources. The digital position resolution of a typical display is 9 bits for location of Y and 9 bits for location of X, resulting in 512×512 discrete plotting positions.

AMPLIFIER

A special deflection amplifier in the displays provides for alphanumeric positioning with a sine wave response of 50 KC. A video amplifier with a 40 MC response provides alphanumeric, symbolic and graphical unblanking as well as video modulation.

MAINTENANCE

Because maintenance is a major factor in military displays, Stromberg-Carlson consoles can offer front access to all components and maximum self-checking. The logic circuitry is all silicon and solid-state. Equipment is either hard mounted or shock mounted. CHARACTRON Tubes, mounted appropriately, have been exposed to 50G shock for 11 milliseconds without harm, and can take almost any shock that does not fracture the glass. These sturdy tubes have already been used in a portable battlefield display console.

INTERCHANGEABILITY

Stromberg-Carlson has developed a standard display concept which will permit interchangeability of consoles. By ordering several interchangeable displays, the user can receive the economic benefits of quantity production. Higher reliability can be achieved in the standard display and the logistic support becomes easier and less costly.

SPECIAL WINDOW TUBE

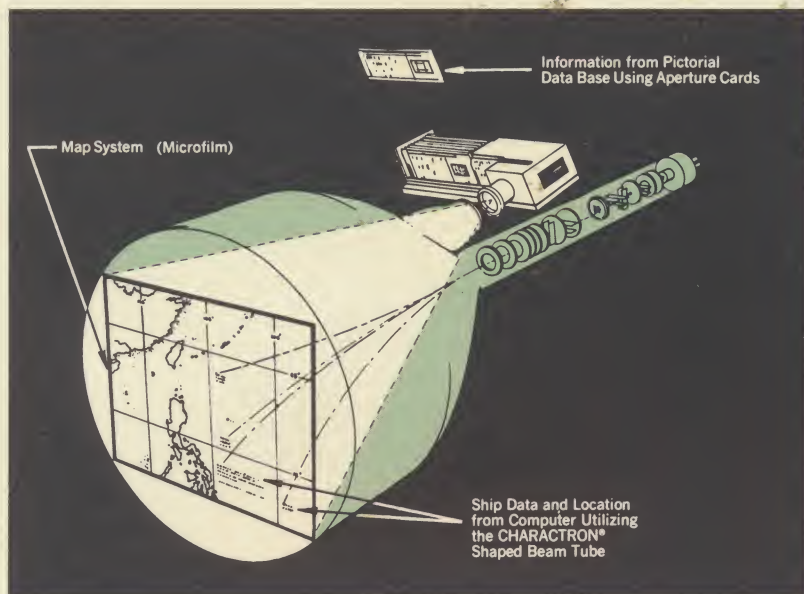
In some situations, it is necessary to continuously repeat certain data, such as a map, on the face of the tube while changing other data, such as target movements. This may be done easily with a "picture window" tube. In this tube, changing data from the computer, radar or communications link are presented in the usual manner. Repetitive data are projected through a window in the rear of the tube to the faceplate. A computer-controlled or manually operated, random access slide file projector is used to project the repetitive data. In a typical application, a geographic map of an area is projected on the face while the computer presents changing data. As the area under surveillance changes, the operator or computer selects another slide. The slides may contain maps, forms or graphs.

TIME SHARE TUBE

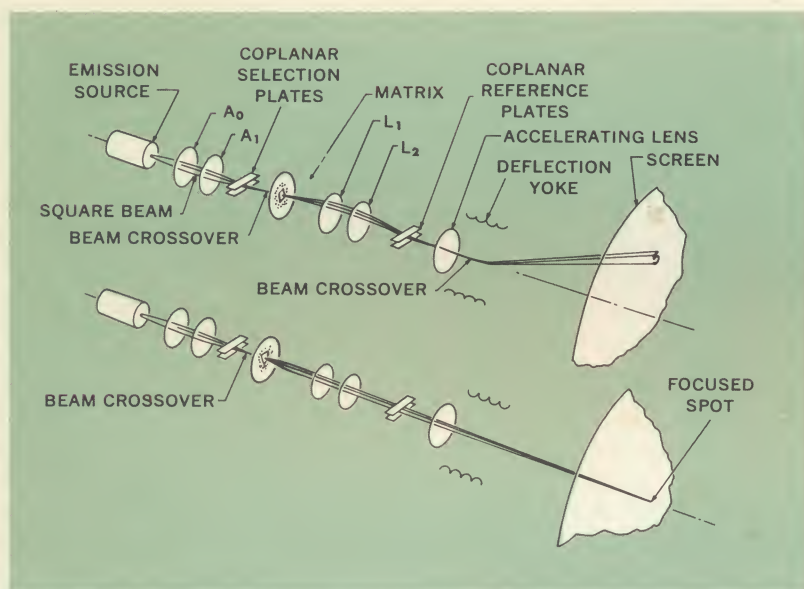
A special version of the CHARACTRON® Tube may be operated in three different modes on a time share basis: character shaping, raster scan and spiral scan. All alphanumeric data are presented using the character-shaping principle while raster and spiral scanning are accomplished by projecting the electron beam through a special aperture in the matrix for spot writing. In the raster scan mode, a high resolution video picture of 800 lines is possible. The spiral scan operates at a 800-1000 line rate. As a result, one tube displays a video picture, a radar report, and characters and symbols with shaped beam resolution.

TWO-GUN TUBE

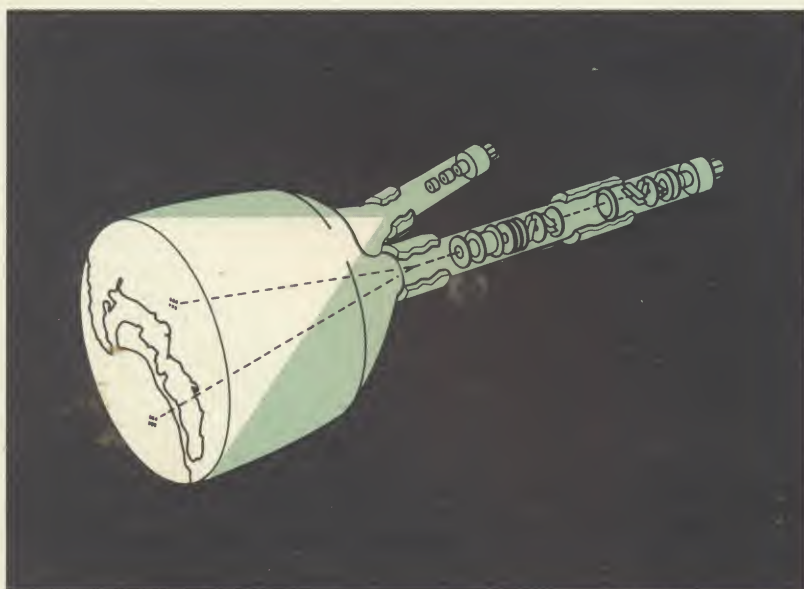
For short range radar requiring high rotation speeds of perhaps 25 times per minute and many hits to build an image, there may not be sufficient time remaining for forming alphanumeric symbols. In these cases a two-gun tube can be used in the Stromberg-Carlson military displays. One gun produces characters while a second gun generates high resolution video images including scan converter readout or raw radar data. The two guns operate simultaneously and without interference.



Special Window Tube



Time Share Tube Optical System



Two-Gun Tube

RESOLUTION AND BRIGHTNESS

The character resolution of tubes in the Stromberg-Carlson displays is measured at 8,000 lines per display diameter which demonstrates high legibility and clarity. Brightness of 50 to 100 foot lamberts is provided.

COMPUTERS

The displays operate efficiently with any digital computer that is reasonably compatible as far as word formation is concerned. Computer-to-display hardware interface and display buffer storage have been provided for a wide variety of data processing and display systems.

**OTHER
STROMBERG-CARLSON
DATA PRODUCTS**

S-C 4400 Document Recorder



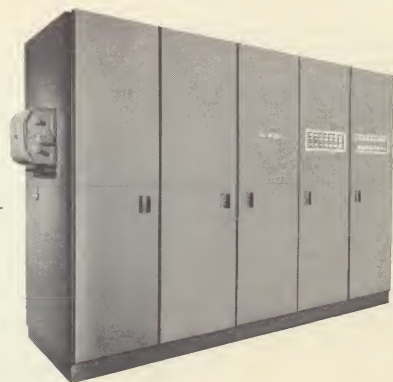
S-C 1100 Inquiry Display System

*S-C 1200 Digital-To-Video
Display System*



S-C 3070 Electronic Printer

S-C 4020 Computer Recorder



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